

Fast-Light Enhanced Fiber Gyroscope, Phase I

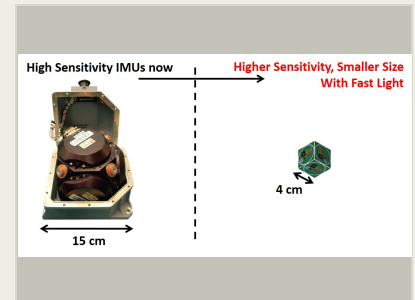
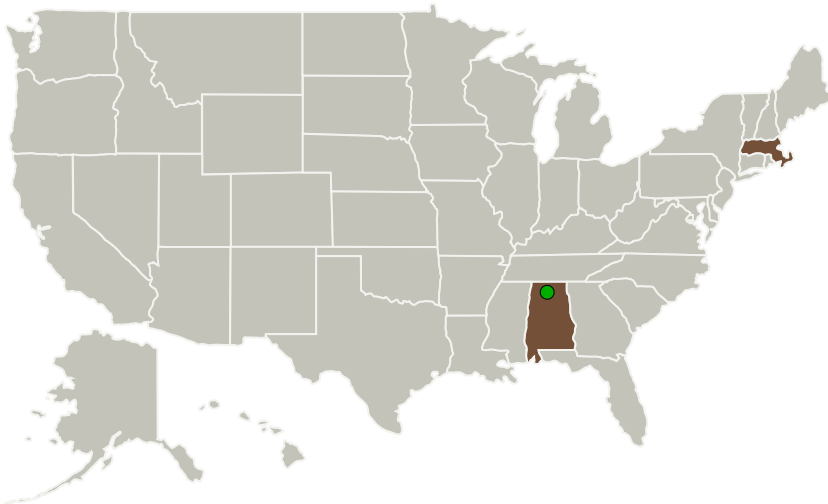
Completed Technology Project (2016 - 2016)



Project Introduction

Current state-of-the-art navigation systems incorporate optical gyroscopes and optical accelerometers as inertial sensors. These devices contain no moving parts and can sense rotations and accelerations with high bandwidth. However, there is a fundamental tradeoff between the size of an optical gyroscope and its sensitivity. Highly sensitive gyroscopes are needed to meet navigation goals, but Size, Weight and Power (SWaP) are extremely precious resources in spacecraft or UAVs. Enhancing the sensitivity of existing devices, reducing their size, or both can allow the use of inertial navigation in smaller airframes, or free up room to include larger mission payloads for scientific or military purposes. Using fast-light effects generated in fiber with Stimulated Brillouin Scattering, we will enhance rotation sensitivity of conventional Ring Laser Gyroscope, to develop IMUs that will deliver higher performance and/or lower SWaP than a traditional navigation system. Previous results have shown sufficient fast-light effects with COTS components to demonstrate the technology, while numerical analysis indicates that a gyro could provide rotation sensitivities as low as 10^{-8} rotations/second. In the proposed Phase I work, we will demonstrate fast-light enhancement of an RLG in the lab for the first time and analyze factors affecting the performance and stability of the system in order to verify specs and design a prototype for construction in Phase II.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
MagiQ Technologies, Inc.	Lead Organization	Industry	Somerville, Massachusetts
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations

Alabama	Massachusetts
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Project Transitions

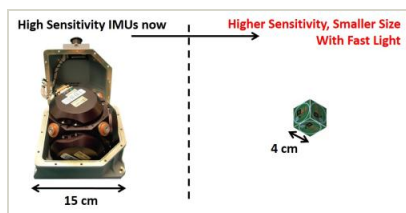
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

Closeout Documentation:

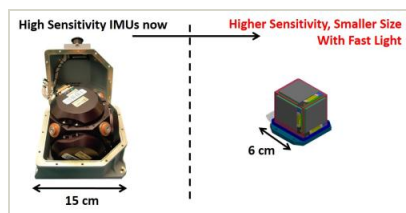
- Final Summary Chart(<https://techport.nasa.gov/file/139817>)

Images



Briefing Chart Image

Fast-light Enhanced Fiber Gyroscope, Phase I
(<https://techport.nasa.gov/image/136399>)



Final Summary Chart Image

Fast-light Enhanced Fiber Gyroscope, Phase I Project Image
(<https://techport.nasa.gov/image/129448>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MagiQ Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

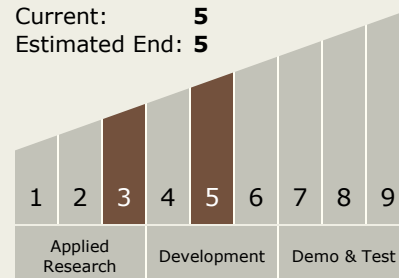
Carlos Torrez

Principal Investigator:

Caleb A Christensen

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
 - └ TX17.2 Navigation Technologies
 - └ TX17.2.3 Navigation Sensors

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System